OAK RIDGE NATIONAL LABORATORY 1458

CENTRAL FILES NUMBER

48-9- 146

[redacted]

Date: September 20, 1948

Subject: Waste Disposal Design Data

By: Stuart McLain

To: Lane, Culler, Winters and Steahly

File

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This document consists of
5 pages.

Copy 8 of 22 Series A.

OAK RIDGE NATIONAL LABORATORY
OAK RIDGE, TENNESSEE

September 20, 1948

To: J. A. Lane
F. L. Culler
C. E. Winters
F. L. Steahly

From: Stuart McLain

Subject: Waste Disposal Design Data

Introduction

The Austin Company has requested that the Laboratory furnish design data and information which will permit them to carry out preliminary design and cost estimations of a waste disposal system for the Laboratory's permanent research facilities. Mr. Rucker has requested that I collect this information and present it to the Austin Company through Mr. J. C. Stewart. Your help will be needed in assembling the necessary information and data. The purpose of this memorandum is to indicate the problems on which the Austin Company will assist the Laboratory in design.

It was agreed in a conference of the Laboratory's representatives with Mr. Brooks of the Atomic Energy Commission and representatives of the Austin Company that a statement of the problems involved would be submitted to the Austin Company on September 17, 1948 and that a complete detailed study would be submitted not later than November 1, 1948. In addition frequent conferences will be held to supply as many details to the Austin Company as possible. Mr. Culler will prepare a memorandum to be sent the Austin Company presenting design principles of especial interest in the design of radioactive waste handling equipment. This memorandum will serve as the preliminary statement of the problems involved.

In general the Austin Company will assist us in the design of improvements in our present waste disposal system and in the design of new facilities to take care of the wastes from the new isotope area and research facilities.

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The present plant and research facilities and the proposed isotope and research facilities will produce various gaseous, liquid, and solid wastes. All these wastes must be decontaminated to permit their disposal to the environment or they must be safely stored permanently.

Gaseous Wastes:

Radioactive gaseous wastes are evolved from the existing pile cooling system, from operation of the present isotope buildings, the pilot plant, the research laboratories and the incinerator. New and proposed facilities such as the new semi-works, 706-HB, the new isotope area, and research facilities will evolve additional amounts of contaminated gases. Particles from the waste tank farm and dusts from White Oak Creek,as well as radioactive dusts which come from roads on which radioactive particles have settled, add to the problems. Ideally, all radioactive material should be removed from all waste streams. This would include the removal of the radioactive fixed gases such as argon and krypton. In fact, these are our instructions from the Atomic Energy Commission. However, we must take a practical view of what we can do in the immediate future. For this reason no attempt will be made to design equipment to remove the radioactive fixed gases. This problem must be left for later attack and probably by other agencies. Likewise, all solid particles should be removed from the gases. As an immediate practical design viewpoint the removal of 99.9% of all particles .1 micron diameter and all larger particles will be our design goal. Every effort possible will be made to remove particles less than .1 micron diameter from the gases.

All off-gas streams, cooling air, and circulating air streams will be treated to remove acid gases, iodine, and solid and liquid particles. The gases will then be disposed of by exhaustion to stacks. All waste treatment systems must be designed to permit separation of the activity removed either in liquid or solid streams; resistant to the wastes; resistant to the agents, if any, used in removing the activities; resistant to corrosion attack by mineral acids used in decontaminating the equipment; mechanically operable over long periods of time; and easily decontaminated and serviced.

Of the problems mentioned above,first attention is to be given to the removal of the solid particles carried by the pile cooling air. The next problem will be the removal of solid and soluble radioactive gases carried by the isotope and pilot plant off-gases. Since the pile cooling air does not contain acid gases or iodine, it will be necessary to remove solid particles only. Discussions already held with representatives of the Austin Company have introduced them to the particle problem and, in fact, they have already started work on the pile problem.

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In respect to the gases from the isotope area and the pilot plant, data will have to be obtained from the Air Reduction Company or from Hanford to permit the design of the equipment for the removal of iodine. Perhaps we can contract with the Air Reduction Company to design the equipment for us. In respect to scrubbing out the acid gases, development work must be done. A memorandum will be addressed to the Chemistry Division asking assistance on this part of the work. The Technical Division must arrange to measure or estimate the amount of air and gases, the source and amounts of activities present, and decide with the Austin Company whether several separate purification systems are to be installed or the gases are to be collected and a single purification system installed.

The Austin Company will not be asked to assist in the decontamination of areas contaminated by radioactive particles.

Liquid Wastes:

There are three general classes of liquid wastes as follows:

a. The first class of liquid wastes is that containing fissionable material such as uranium, plutonium and thorium. Since adequate recovery and decontamination processes have not been worked out for all of these, it will be necessary to store the solutions and foster such research and development work. These solutions come mainly from the chemical processing areas and research and development areas. In general, the solutions are very highly radioactive. As far as the Austin Company is concerned at the moment, the solutions are to be stored.

b. The second class of wastes are the decontaminated chemical wastes and are distinguished from the first class in that they do not contain any fissionable metals. The sources of such wastes are the radioisotope separation processes, chemical separations processes, exhaust air fan seals, solutions used in decontamination of various plant facilities and laboratory experimental and analytical wastes. These solutions vary greatly in activity and pH. In general the solutions are relatively dilute and large scale concentration by evaporation is possible before crystallization takes place.

c. The third class of liquid wastes is made up of the cooling water from the jackets of processing vessels, various laboratory operations, condensers, etc. These wastes are relatively non-radioactive. They do not require concentration or prolonged storage. Possibly they can be decontaminated by ion exchange; such a procedure is under study at the present time.

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The above three classes of liquid wastes must be handled in completely separate systems. Wastes containing fissionable material must be kept isolated from one another, i.e., uranium, plutonium, and thorium wastes must be kept separate. In addition, uranium wastes of different isotopic enrichment must be kept separate.

In order to handle all the wastes from the present and proposed facilities, new collection systems and tank farm facilities must be designed. The tanks in the present tank farm were built for three years service. These tanks are gunnite lined. They must be rebuilt or replaced in the near future. Since the new research facilities are to be located at some distance from the present tank farm, an entirely new tank farm is indicated.

Estimates of the values of each class of waste, the activities present, the concentrations permitted, the storage times required, and the methods of handling for each area must be made up. Whether separate collection tanks will be used for each wing of each research building or the wastes will be run into hot pipe lines must be decided by the Radiation Hazards Committee.

At present an evaporator is undergoing detailed design for use in concentration of the hot wastes. If this proves successful, it will be augmented by drying equipment that will permit reduction of the wastes to solids for canning and storing.

The redesign of the present tank farm must be started soon in order that facilities will be available to handle the liquid wastes from the new isotope area.

In order to augment the handling of process cooling water the load on White Oak Creek must be evaluated. New facilities including an additional retention dam may be necessary in the Creek. The retention basins in the area must be covered to prevent algae from forming radioactive dusts.

Solid Wastes:

The solid wastes, while extremely varied, can be divided into combustible and non-combustible wastes. If handled properly the combustible wastes can be incinerated, the stack gases scrubbed and dust removed, and the ash canned for burial. The non-combustible wastes must be buried. Some pieces of contaminated equipment may be stored in enclosed isolated areas.

Since the present incinerator has become contaminated due to hot wastes, a new incinerator may have to be designed and built. The Health Physics Division is making a survey of this situation.

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Summary:

Immediate study of each of the above problems is urgently required. In general, these problems will take priority over other work of the Technical Division. Where necessary other divisions should be requested to give us aid in any way possible to obtain solutions to these problems.

The recovery of the uranium precipitated in our existing tank farm must await solution of the above problems.

Stuart McLain

Stuart McLain

SMcL:lwb

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